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MOA Number: FNA/08-02-01 Effective Date: 6/18/02

MEMORANDUM OF AGREEMENT
between the
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
and
FEDERAL AVIATION ADMINISTRATION
concerning
DEVELOPMENT AND EVALUATION OF
ENHANCED SITUATIONAL AWARENESS TECHNOLOGIES

1. PURPOSE

This Memorandum of Agreement (MOA) establishes a cooperative research collaboration between the National Aeronautics and Space Administration (NASA) and the Federal Aviation Administration (FAA) for the development and evaluation of enhanced situational awareness technologies for lateral and vertical navigational guidance for the intended route, terrain, obstacles, and traffic, and related technology solutions to runway incursions. This MOA is written in accordance with the guidelines established by the existing FAA/NASA Memorandum of Understanding (MOU) for Aviation Safety Research, Number FNA-08, dated July 2, 1999.

2. BACKGROUND

The demand for air travel is expected to increase over the coming two decades, more than doubling by 2017. Without an improvement in the accident rate, such an increase in traffic volume would lead to a projected 50 or more major accidents a year worldwide - a nearly weekly occurrence. In 1997, a White House Commission on Aviation Safety and Security called for an 80 percent reduction in the rate of fatal aviation accidents by the year 2007. Both FAA's Safer Skies initiative and NASA's Aviation Safety Program (AvSP) share this common national goal.

The MOU between NASA and the FAA established the primary goal of preventing accidents through the development and deployment of existing and new technologies. The FAA, through the Safe Flight 21 Program is developing and demonstrating nine NAS operational enhancements. Included in the nine are cost-effective controlled flight into terrain (CFIT) avoidance, improved terminal operations in low visibility, enhanced see and avoid, and improved surface navigation for the pilot. In addition, the Runway Safety Program is developing solutions to reduce the frequency and severity of runway incursions, and also improving the safe and efficient movement of aircraft and vehicles on the airport surface. NASA's Synthetic Vision Systems (SVS) Project, part of the AvSP, is developing new technologies to provide immediate, clear-day equivalent visual awareness and avoidance of terrain and obstacles in any weather or lighting condition. This will be accomplished through the cost-effective use of synthetic/enhanced vision displays, worldwide terrain databases, and Global Positioning System (GPS) navigation. The ultimate goal

of the SVS Project is to eliminate low visibility as a causal factor of civil aircraft accidents. In addition, SVS may increase the efficiency of the National Airspace System by allowing precision Instrument Meteorological Conditions (IMC) operations to many more runways than permitted today by providing safe operations in lower weather minimums. This MOA will promote the coordination and integration of research and development (R&D) activities contributing to the common safety goals and initiatives of both the NASA and the FAA.

3. SCOPE/OBJECTIVE

This MOA encompasses the cooperative efforts required to develop and evaluate the following products, the goal of which is to improve aviation safety in the coming decade and beyond:

1) Commercial and business aircraft synthetic/enhanced display concepts and procedures;
2) General aviation aircraft synthetic/enhanced display concepts and procedures;
3) Runway incursions and collision avoidance; and
4) Terrain, obstacle, and airport databases.

The objective of this MOA is to establish a high-level agreement that a plan will be implemented regarding the working relationship and process by which resources can be authorized for the most effective use of NASA and FAA capabilities and facilities, with a major emphasis on assuring successful and expeditious transfer of new concepts and technology into synthetic/enhanced situational awareness display products.

Copies of the FAA and NASA Project Plans are attached. These plans detail the respective multi-year efforts, and include:

FAA:
- Safe Flight 21 Master Plan, Version 2.0
- National Blueprint for Runway Safety
- Airport Surface Architecture Roadmap

NASA:
- Synthetic Vision Systems Project Plan

4. STATEMENT OF WORK

NASA and the FAA will define tasks to meet the overall goals/objectives of this MOA to ensure a coordinated series of activities that will improve aviation safety through the application of enhanced situational awareness technologies. An individual Statement of Work (SOW) for the tasks will, at a minimum, include: agreements for temporary detail of personnel between agencies when necessary; use of major facilities, including appropriate simulation facilities; funding approaches and authorization, including transferring of funds between agencies; and, mechanisms for working with contractor teams.

A. ACTIVITIES

NASA and the FAA will jointly perform the activities listed below. These activities will include, but not be limited to, the following phases: components/systems requirements, components/ systems assessments, concept definition, component validation through system testing, and flight tests.

1. This activity includes developing, prototyping, and validating the safety and operational benefits of integrated flight critical concepts of synthetic/enhanced vision systems for commercial and business aircraft in both retrofit and future aircraft applications. Display concepts, such as head-up displays (HUD) and size/field-of-view effects on head-down concepts, will be evaluated in simulation and flight for terrain and situational awareness gains. Developing a Concept of Operations document will also be critical to the success of this activity and must include definition of the intended function of the equipment. Defining a clear path for certification and operational approval appropriate for the intended function and Concept of Operations will also be necessary. Other activities include pilot performance/workload evaluations using state-of-the-art human performance assessment tools and techniques and developing methods for integrating weather hazard reporting and advanced traffic display concepts.

2. This activity includes developing, prototyping, and validating a situational awareness enhancement system utilizing a database, display symbology, and precise navigational information to create synthetic/enhanced views of the current out-the-window environment for display to General Aviation (GA) pilots. The emphasis of this activity will be to produce certifiable, cost effective, tactical products for retrofit and future GA aircraft. Simulation and flight test data will be gathered to investigate topics such as advanced GPS navigation; datalink communications; advanced avionics (enroute altitudes, weather information, surveillance, CFIT protection, traffic awareness, etc.); guidance cueing; and pilot performance (reduced workload, increased situational awareness, increased navigational performance during IFR operations, etc.). Certification strategies and concepts benefit analyses will also be considered under this effort. NASA will establish a formal role in the FAA Capstone initiative to improve GA aircraft safety in the hazardous terrain and weather conditions of Southeast Alaska.

3. This activity includes developing, prototyping, and validating technologies utilizing imaging sensors (Forward-Looking Infrared Radar, low-light-level Charge-Coupled Device, Millimeter Wave Radar, Passive Millimeter Wave Camera, etc.) merged with flight display symbology and precise GPS navigational information to create images of the current external environment for display to the flight crew in all visibility conditions. Activities will include, but not be limited to, image fusion and symbology blending and application of non-invasive performance measures for gathering pilot performance data for head-up, head-down, and head-level displays.

4. This activity includes developing, prototyping and validating affordable, certifiable concepts for runway incursion technologies to include, but not be limited to, moving map displays of

runways and taxiways, surface routing information, aircraft position information, other traffic information, advanced datalink technologies, and runway incursion alerting algorithms. This activity will include flight evaluations of the Safe Flight 21 Program concepts, and will provide technical and operational system performance assessment for feasibility of generating an airport surface database and incorporating runway incursion warning systems into current and future cockpit designs.

5. This activity includes developing and defining methodologies and processes for the provision, verification, and maintenance of applicable worldwide regional-to-global terrain databases suitable for synthetic/enhanced vision applications. The goal of this activity is to provide to the flight crew an intuitive perspective of the aircraft's external environment in all visibility conditions. Considerations include, but are not limited to, Government/Industry roles in the establishment of a database infrastructure; a standardized database format; a clearly defined path for worldwide terrain database certification; and terrain, obstacle, and airport database requirements for various airports, vehicle classes, and flight regimes.

6. NASA and industry may form a Certification Team(s) that will propose a certification bases for the intended function of the equipment, develop certification plans (for both the equipment and installation), and conduct tests that demonstrate compliance methodology. The FAA will work with this team to ensure the validity of the bases of certification, and the acceptability of the certification plans and their methodology.

B. RESOURCES

The intent of this MOA is for NASA and the FAA to develop a resource plan that takes into account current activities such as the Operational Evolution Plan and National Airspace System Modernization. This plan should include funding of any cooperative or joint programs consistent with the authority and approved operating plan of each agency. The allocation of those resources will be specified within the SOW for each approved activity and annexed to this MOA. The annex will include resources such as personnel, facilities, and funding necessary to perform each specified task.

Upon obtaining the appropriate approvals, each agency has the authority to award contracts, grants, cooperative agreements, and other transactions as necessary to perform a specified task. Such awards are to be made in accordance with applicable center/agency policies and procedures.

(1) Transfer of Funds

To the extent funds may be transferred between FAA and NASA for services and/or goods provided on a reimbursable basis, the authority of the Economy Act, as amended, 31 U.S.C.§§ 1535 and 1536; Section 203(c) of the National Aeronautics and Space Act, as amended, 42 U.S.C. § 2473(c); or sections 226 and 227 of the FAA Reauthorization Act of 1996, 49 U.S.C. § 106 (l)(6) and (m), as applicable, may be cited. The reimbursable agreement document is an interagency agreement (IA) for the FAA and a purchase order (PO) for NASA, or other authorized method of intergovernmental funding transfer.

This agreement is mutually beneficial to both NASA and FAA with both agencies waiving any administrative and/or program overhead costs for transferred funds.

(2) Anti-Deficiency Act

All activities under or pursuant to this agreement are subject to the availability of appropriated funds, and no provision shall be interpreted to require obligation or provision of funds in violation of the Anti-Deficiency Act, 31 U.S.C. § 1341. This MOA is not a funding document and does not represent the obligation or transfer of funds.

C. SCHEDULE

Execution of the FAA and NASA activities outlined in Paragraph 4A will span fiscal years FY-01 through FY-05. The individual task schedules will be specified within the SOW for each approved activity and annexed to this MOA.

D. REPORTS

Technical reports generated from work performed under this Agreement will be published, in accordance with Paragraph 7 of this document, by the organization having primary responsibilities, with due acknowledgment and credit given to each organization's contribution. Research results and deliverables will be released through routine FAA and NASA channels.

5. REPRESENTATIVES

A. TECHNICAL REPRESENTATIVES

The individuals listed below are responsible for the oversight of this MOA at their respective headquarters and/or centers; however, they do not have the authority to alter any of the terms of this MOA. Any requests for changes must be made in accordance with Paragraph 9 of this document. The central point of interagency coordination and information for this MOA is the FAA R&D Field Office at NASA Langley Research Center, Hampton, Virginia.

1. Samuel Morello, Director, Aviation Safety Program Office, NASA Langley Research Center, Mail Stop 229, Hampton, VA 23681-2199, tel: 757-864-9100, fax: 757-864-2166, s.a.morello@larc.nasa.gov

2. David Ford, Manager, AND-500, DOT/Federal Aviation Administration, 800 Independence Ave., S.W., Washington, DC 20591, tel: 202-493-4939, fax: 202-267-5111, david.ford@faa.gov

3. Jim Jones, AIR-3, DOT/Federal Aviation Administration, 800 Independence Ave., S.W., Washington, DC 20591, tel: 202-267-9584, fax: 202-267-5364, james.c.jones@faa.gov

4. Steve Pansky, ARQ-200, DOT/Federal Aviation Administration, 800 Independence Ave., S.W., Washington, DC 20591, tel: 202-385-7753, fax: 202-385-7710, steve.pansky@faa.gov

B. CONTRACTUAL REPRESENTATIVES

Should this MOA result in the transfer of funds between FAA and NASA, procurement officials will be designated at the respective headquarters and/or centers. These officials will be listed in the interagency agreement (IA) for the FAA or a purchase order (PO) for NASA, or other authorized method of intergovernmental funding transfer.

C. DISPUTE RESOLUTION

In accordance and compliance with appropriate FAA and NASA policies and procedures, the Technical Representatives, identified in Paragraph 5, will attempt to resolve any disputes arising from the implementation of this MOA. If they are unable to come to agreement on any issue, then the dispute will be referred to the NASA and FAA Program Directors, or their designated representatives, for joint resolution.

6. LIABILITY AND RISK OF LOSS

Each party agrees to assume liability for its own risks associated with agreements and activities undertaken in this MOA.

7. INTELLECTUAL PROPERTY AND DATA RIGHTS

A. DISSEMINATION OF INFORMATION

Disclosure of information related to this MOA, or generated under any agreement entered into under this MOA, for government purposes, or pursuant to a request under the Freedom of Information Act (FOIA, U.S.C. 552a), or public dissemination for any other reason, shall be coordinated between the parties prior to disclosure or dissemination.

B. RIGHTS IN TECHNICAL DATA AND COMPUTER SOFTWARE

In any agreement entered into under this MOA, the parties will acquire those rights in data sufficient to accomplish the purposes of this MOA, and the specific purposes of the agreement. Rights other than those routinely acquired under FAA and NASA contract, as applicable, shall be identified by the parties prior to entering into the contract.

C. PATENT AND INVENTION RIGHTS

Custody and administration of inventions made under this MOA, or any other agreement entered into under this MOA, will remain with the party whose employee made the invention. In the event an invention is made jointly by employees of the parties, or by an employee of a contractor, grantee, or other entity under a funding agreement with a party, the parties will consult and agree as to future actions toward patent or other protection for the invention. Disputes under this section will be processed consistent with Article 5C of this MOA.

8. PERIOD OF PERFORMANCE

The period of performance for this research program shall commence upon the effective date of this agreement and shall remain in effect for five (5) years unless terminated by mutual agreement as outlined in Paragraph 9B.

9. MODIFICATION/AMENDMENTS/TERMINATION

A. MODIFICATION

This MOA may be modified only upon the mutual written consent of both agencies. Modifications must be signed by the authorized representatives of the FAA and NASA, or their designees. No oral statement by any person shall be interpreted as modifying or otherwise affecting the terms of this Agreement.

B. RIGHT TO TERMINATE

Either party may terminate this MOA upon 180 days written notice to the other party, signed by the authorized representative of the terminating party, or the designee of such representative. The notice shall reference the title and identifying number of this MOA, and shall contain the effective date of the termination. Upon termination, each party will refund any portion of those funds that have been advanced by the other party, but not yet expended in connection with work under this MOA.

10. AUTHORITY

A. NASA

This agreement is entered into by NASA pursuant to Section 203(c) of the National Aeronautics and Space Act of 1958, as amended, 42 U.S.C.§ 2473(c).

B. DOT/FAA

This agreement is entered into by FAA pursuant to Sections 226 and 227 of the FAA Reauthorization Act of 1996, 49 U.S.C. §106 (l)(6) and (m).

C. FAA/NASA EXECUTIVE COMMITTEE

This cooperative activity is established under the agreement for cooperation between the FAA and NASA signed by the Administrators on October 9, 1998, entitled "A Partnership to Achieve Goals in Aviation and Future Space Transportation."

11. APPROVALS

Department of Transportation/ Federal Aviation Administration

Charles E. Keegan
Associate Administrator for Research and Acquisitions

Date: 5/8/02

National Aeronautics and Space Administration

for Samuel L. Venneri
Associate Administrator for Aerospace Technology

Date: April 12, 2002

for Nicholas A. Sabatini
Associate Administrator for Regulation and Certification

Date: 6/17/02

Steven Brown
Acting Associate Administrator for Air Traffic Services

Date: 6/18/02